

Serial No.: 10/791,958

Amendments to the Drawings

The attached sheet of drawings includes changes to Fig. 6. This sheet replaces the original sheet including Fig. 6. In Fig. 6, previously omitted element 57 has been added.

Attachments: **Replacement Sheet**

Annotated Sheet Showing Changes

Remarks/Arguments

Applicants respectfully request favorable reconsideration of the subject application, particularly in view of the above amendment and the following remarks. There is no additional fee for the above amendment as the number of independent claims and the total number of claims in the application remain unchanged.

Applicants have amended Claims 12, 14-15, 17-18, and 22 to correct certain informalities and provide clarifications of the claimed invention. In particular, Claim 12 has been amended by deleting “said” in lines 2 and 3. Claims 14-15 have been amended by adding --first-- in lines 1 thereof to identify the light sensitive catalyst material as being the first light sensitive catalyst material. Such amendment is consistent with Claim 11 and, thus, incorporates no new subject matter into the application. Similarly, Claims 17-18 have been amended by adding --first-- in lines 1 thereof to identify the polymer electrolyte membrane layer as being the first polymer electrolyte membrane layer. Such amendment is consistent with Claim 11 and, thus, incorporates no new subject matter into the application. Finally, Claim 22 has been amended to depend from Claim 12 instead of Claim 11.

The drawings have been objected to as failing to comply with 37 CFR 1.84(p)(5) because they do not include reference numeral 57 in Fig. 6 as mentioned in the description. In response to this objection, Applicants have amended Fig. 6 by

adding the missing reference numeral. Both a replacement sheet and an annotated sheet are enclosed with this response. Applicants respectfully urge that the amended Fig. 6 overcomes this objection to the drawings.

The disclosure has been objected to because of certain informalities in paragraph [0030], in particular, incorrect reference numerals in regard to Fig. 6 in lines 7 and 9. The Examiner has indicated that line 7 contains the number 54 defined for both the photoanode and the photocathode and line 9 contains the number 58 defined for the light transmissive wall where 58 is used prior thereto for the electrode separator and 52 is used for the light transmissive wall. In response to this rejection, Applicants have amended line 7 of paragraph [0030] by deleting reference numeral "54" as referencing the photocathode and in its place inserting --53--. In addition, Applicants have amended line 9 of paragraph [0030] by deleting reference numeral "58" as referencing the light transmissive wall and in its place inserting reference numeral --52--. Finally, Applicants have reversed the order in which the terms hydrogen and oxygen are presented in lines 6 and 10 of paragraph [0030] so as to be consistent with the reference numerals corresponding thereto. Applicants respectfully urge that these amendments to [0030] of the application overcome the Examiner's objection.

Claims 1-28 have been rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the enablement requirement. In particular, the Examiner indicates that the claimed subject matter, a water permeable photovoltaic device, is not described in the specification in sufficient detail to enable one skilled in the art to make or use the invention. Applicants respectfully disagree.

The Examiner argues that the prior art is advanced in terms of photovoltaic photoelectrochemical devices, citing references by Deng et al., Mauk, and Graetzel et al., and that the prior art repeatedly describes methods and apparatuses that protect photovoltaic devices from contact with water, such as by the use of specific layers to protect the cells from contact with the water. The Examiner further argues that, because the prior art teaches away from contact with water for photovoltaic devices, it is not well known how to create a water permeable photovoltaic device, requiring a substantial amount of experimentation to recreate the devices on the part of one of ordinary skill in the art. As a result, the Examiner argues that the invention claimed by Applicants is not enabled. Applicants respectfully disagree.

Figs. 4 and 5 of the subject application show a water permeable photoelectrode in accordance with embodiments of this invention. As described in paragraphs [0026] to [0029], the photoelectrode comprises a polymer electrolyte

membrane layer 38, a metallic substrate 37 disposed on the surface of the polymer electrolyte membrane layer, a solar cell 31 disposed on the surface of the metallic substrate 37, and a light sensitive catalytic layer 33 disposed on the side of the solar cell opposite to the side on which the metal substrate is disposed. *The specification lists some of the materials suitable for use in the light sensitive catalytic layer as being Pt, Ni, Fe, Ti, light sensitive dyes, and combinations thereof along with a p-type or n-type semiconductor.* As noted by the Examiner, the prior art teaches that photovoltaic cells used in photoelectrodes are covered by specific layers to protect the cells from contact with water. For example, Mauk, U.S. Patent Application Publication 2004/0003837 A1, cited by the Examiner, teaches a solar cell diode 10 having an n-type region 11 and a p-type region 14. This solar cell is covered on one side by intermediate elements 15, 16 and 17 positioned above the n-type region 11 and by a contact 21 formed of aluminum on the bottom of the solar cell in contact with the p-type region 14 (paragraphs [0072] and [0074]). In contrast to the teachings of the prior art, *the metallic substrate 37 in accordance with one embodiment of the invention claimed by Applicants is perforated (paragraph [0023]), thereby enabling water to contact and pass through the solar cell 31 to the light sensitive catalytic layer 33, i.e. rendering the solar cell (photovoltaic device) water permeable.* Further clarification of the requirements for using the photoelectrode of this invention for

water-splitting are set forth in paragraph [0028]. Applicants respectfully urge that the components used to produce the photoelectrode of this invention are generally known, except for the water permeability aspect of the photoelectrode, which is described in the specification as being achieved in accordance with one embodiment of this invention by perforating the metallic substrate 37. Accordingly, Applicants respectfully urge that methods or procedures for producing the water permeable photoelectrode based upon the description set forth in the subject application, are well within the expertise of those skilled in the art and, thus, the invention as claimed, i.e. the use of water permeable photoelectrodes, is, in fact, fully enabled by the description, in full compliance with the requirements of 35 U.S.C. 112, first paragraph.

Claims 12, 14, 15, 17, 18 and 22 have been rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which Applicants regard as the invention. In particular, the Examiner has indicated that, in Claim 12, it is unclear if the limitations “second said water permeable photoelectrode”, “second said light sensitive catalytic material layer”, and “second said light transmissive wall” correspond to the original photoelectrode, material layer or wall or brand new ones. In response, Applicants

have amended Claim 12 to eliminate the word “said” from each of the phrases as suggested by the Examiner.

Claims 14 and 15 recite the limitation “said light sensitive catalyst material layer” for which the Examiner has indicated that there is insufficient antecedent basis. In response, Applicants have amended Claims 14 and 15 by inserting --first-- after “said” in each of the phrases as suggested by the Examiner.

Claims 17 and 18 recite the limitation “said polymer electrolyte membrane layer” for which the Examiner has indicated that there is insufficient antecedent basis. In response, Applicants have amended Claims 17 and 18 by inserting --first-- after “said” in each of the phrases as suggested by the Examiner.

Finally, Claim 22 recites the limitation “said first and second light sensitive catalytic material layers” in line 1, for which limitation the Examiner has indicated that there is insufficient antecedent basis. Applicants have amended Claim 22 by changing the dependency of the claim from Claim 11 to Claim 12 as suggested by the Examiner.

Applicants respectfully urge that the above amendments overcome the rejection of Claims 12, 14, 15, 17, 18 and 22 under 35 U.S.C. 112, second paragraph.

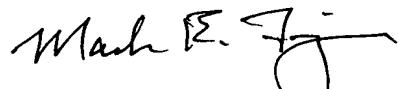
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Conclusion

Applicants intend to be fully responsive to the outstanding Office Action. If the Examiner detects any issue which the Examiner believes Applicants have not addressed in this response, Applicants urge the Examiner to contact the undersigned.

Applicants sincerely believe that this patent application is now in condition for allowance and, thus, respectfully request early allowance.

Respectfully submitted,



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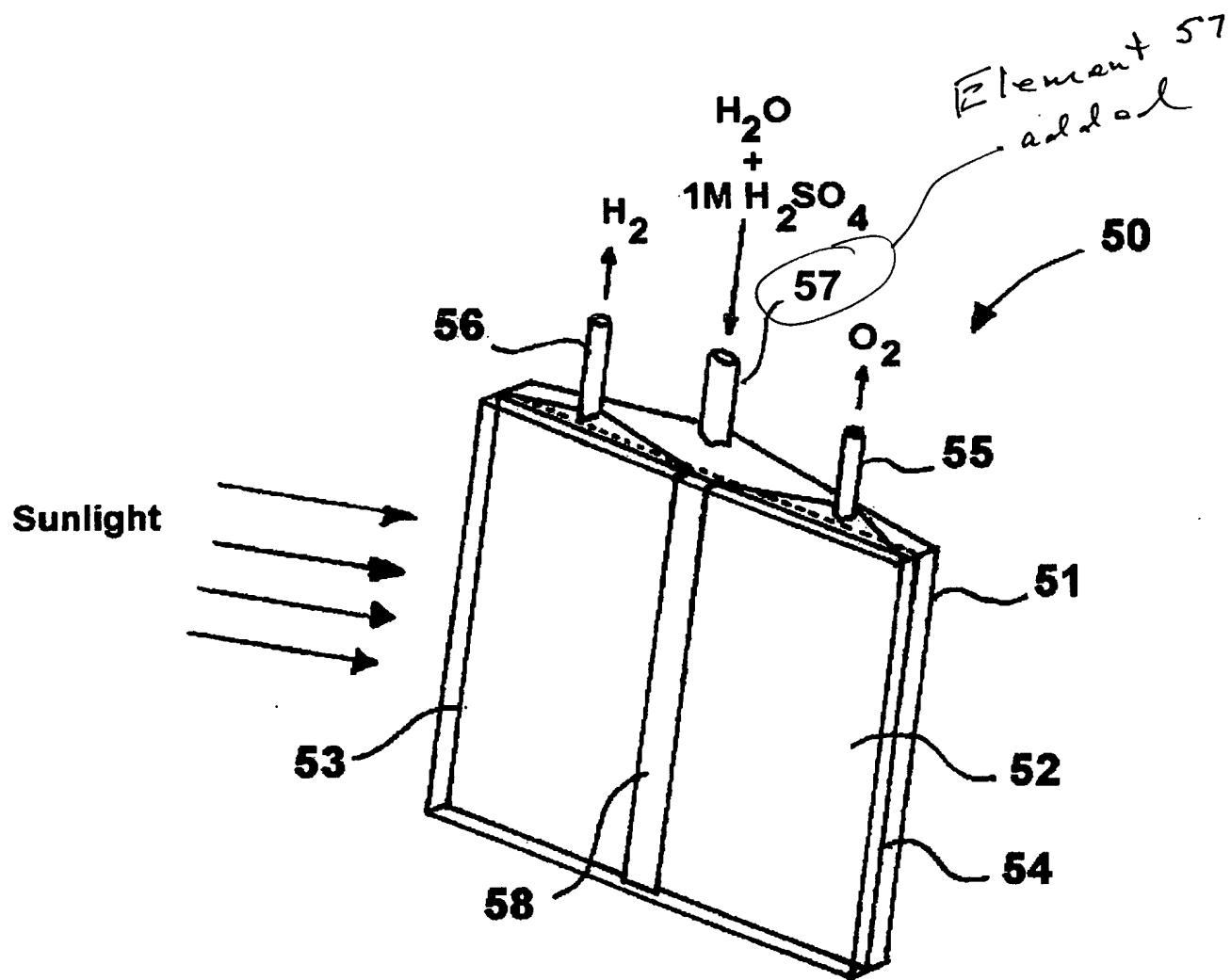


Fig. 6